MATHEMATICAL SIMULATION AND REALIZATION OF ECM PROCESS OF DROP DIES

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The electrochemical technology is used now in Kamsky Automaker Amalgamation for the manufacturing of some auto-car parts as well as in tool manufacturing, particularly for production of drop dies. The drop dies are produced from the intractable materials with rather narrow restrictions on the size tolerances. That's why the electrochemical technology is preferable in this case. However, following to the increased quality specifications for machine part production and with the purpose of the reduction of production price it is need modify ECM technology to more precise and effective. In this connection the team of researchers of Kazan State University and Kamsky Polytechnic Institute in cooperation with colleagues from the forge factory of the Kamsky Automaker Amalgamation have carried out a complex of working in the mathematical simulation of ECM process as well as in developing of the mathematical methods for cathode-tool designing and the calculation of the anode shapes.

For the stationary ECM a new method for calculation of the part shapes for the some configurations of cathode-tools is worked out on the base of the theory of analytical functions. The method uses two dimensional apprximation of the electrostatic field in the working gap. The computer program for calculation of the cathode-tool form is written taking into account specific features of the electrostatic field in the presence on the cathode-tool surface the isolated sites or sites with large curvature.

For the case of the stationary state ECM the method for control of a part shape by means of the variable electric potential on the cathode-tool surface is designed. The corresponding ill-conditioned mathematical problem is solved by the Tickhonov's regularization technique.

In the approximation of the potentiality the problem of the joint calculation of the electrostatic and hydrodynamic fields is solved in two-dimensional formula-

tion. The evolved method allow to find out a gas cavern in electrolyte and thus to design cavernless cathode-tools.

Under the assumption that a curvature radius of electrode surfaces is much less than the size of the working gap the complex computer model, taking into account much number of different factors is designed. The electrolyte in this model is considered as the mixture of incompressible fluid and gas bubbles. It is assumed in general case, that both phases have equal pressure, but different velocities. The cathode surface can move with time under some given law, for example, to vibrate. The system of equations is written for determination of physical fields of the electrolyte flow and of the metal output. The system is solved by the finite differences method.